

Reissue Claims

1. (Original) A method for reforming hydrocarbons into shorter chain unsaturated organic compounds, comprising the steps of:
 - a) providing a molten metal bath, said molten metal bath consisting essentially of an elemental metal which can cause cleavage of at least one carbon-carbon bond of a hydrocarbon component of a hydrocarbon-containing feed;
 - b) directing said feed into the molten metal bath at a rate which causes the concentration of carbon in the molten metal bath to be lower than the saturation limit for carbon of said bath at the operating conditions of said molten metal bath, whereby the hydrocarbon component of the feed can exhibit cleavage of at least one carbon-carbon bond of the hydrocarbon component of said feed; and
 - c) establishing and maintaining conditions in said molten metal bath to cause cleavage of at least one carbon-carbon bond of the hydrocarbon component to produce unsaturated organic compounds, as products of said cleavage.
2. (Original) A method of claim 1 wherein the molten metal bath includes a transition metal component.
3. (Original) A method of claim 1 wherein the molten metal bath provided has a melting point of greater than about 500° C.
4. (Original) A method of claim 1 wherein the molten metal bath provided has a metal equilibrium carbon solubility of greater than about 0.01% by weight.
5. (Original) A method of claim 1 wherein the hydrocarbon-containing feed is directed into the molten metal bath at a rate which causes the residence time of a carbon component of the feed to be greater than that required to cause the molten metal bath to dissolve said carbon under the operating conditions established and maintained in the molten metal bath.

6. (Original) A method of claim 5 wherein the hydrocarbon component of said feed includes an alkyl compound.
7. (Original) A method of claim 6 wherein the organic hydrocarbon component includes an alkane.
8. (Original) A method of claim 5 wherein the hydrocarbon component includes an aryl compound.
9. (Original) A method of claim 5 wherein the operating conditions of the molten metal bath include establishing and maintaining a temperature in a range of less than about 2,000° C.
10. (Original) A method of claim 9 wherein the hydrocarbon-containing feed is directed into the molten metal bath as a component of a fluid stream that includes an inert gas component.
11. (Original) A method of claim 9 wherein the concentration of the hydrocarbon-containing feed in the fluid stream is in the range of between about five and forty percent, by volume.
12. (Original) A method of claim 11 wherein the hydrocarbon is a component of oil.
13. (Original) A method of claim 11 wherein the hydrocarbon component of the feed includes polyethylene.
14. (Original) A method of claim 5 wherein a bath of molten brass is provided.
15. (Original) A method of claim 5 wherein a bath of molten aluminum is provided.

16. (Original) A method of claim 1 where the hydrocarbon-containing feed contains heteroatoms.

17. (Original) A method of claim 16 where the heteroatoms include sulfur, nitrogen, oxygen, and chlorine.

18. (New) An apparatus suitable for closed and sealed molten metal-based reactions comprising:

(a) an upper portion, wherein the upper portion is characterized by an off-gas outlet;

(b) a lower portion wherein the lower portion is characterized by one or more inlets having one or more lances disposed therein operably connected to an inert gas source;

(c) one or more feed inlets for the introduction of feed streams;

(d) an induction coil disposed within the lower portion;

(e) a means for controlling (1) the rate of introduction of each feed stream, (2) the rate of removal of the off gas, (3) the relative amounts of reaction components, (4) the temperature of the molten metal; and/or (5) the carbon saturation levels of the molten metal bath within residence times of between 0.1 and 5 seconds.

19. (New) The apparatus of Claim 18 comprising one or more feed inlets adapted for the introduction of a carbon-containing material.